

REMARKS

Claims 14-16, 18-20, 22-23, 26-36, and 38-39 are all the claims presently pending in the application. Claims 17, 21, 24-25 and 37 have been canceled. Claim 39 has been added to more clearly define the claimed invention.

It is noted that the claim amendments are made only for more particularly pointing out the invention, and not for distinguishing the invention over the prior art, narrowing the claims or for any statutory requirements of patentability. Further, Applicant specifically states that no amendment to any claim herein should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

Claims 14-38 stand rejected under 35 U.S.C. § 112, second paragraph as indefinite. Claims 14-24 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Geniryoku (JP No. 10-151794) in view of Nemoto et al. (U.S. Patent No. 6,025,213) in view of Yamada et al. (U.S. Patent No. 6,239,490 B1). Claims 25-37 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Geniryoku, Nemoto, and Yamada, in further view of Hide et al (U. S. Pat. No. 5,966,393). Claim 38 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Geniryoku, Nemoto, and Yamada, in further view of Oshio et al (U. S. Pat. No. 6,274,890)

These rejections are traversed in the following discussion.

I. THE CLAIMED INVENTION

The claimed invention (e.g., as recited in claim 14) is directed to a semiconductor light-emitting apparatus of a flip-chip bonding type. The apparatus includes a transparent base comprising an inorganic material, which has on one side thereof a first bonding pad and a second bonding pad to be connected to a pair of lead frames with a space between the first and the second bonding pads where a semiconductor light-emitting element is fixed. The light-emitting element includes a light-emitting layer, a substrate disposed between the light emitting layer and the base, and a positive electrode comprising a light non-transmissible material, the electrode being disposed on an opposite side of the light-emitting layer from the substrate and reflecting light from the light-emitting layer in a direction through the substrate and the base, and the positive electrode being connected by a bonding wire to a surface of one

of the first and second bonding pads, one of the pair of lead frames being connected to the surface. Further, the inorganic material includes a fluorescent material dispersed therein

In another aspect (e.g., as recited in claim 19) the present invention includes a pair of lead frames for use in a light-emitting apparatus of a flip chip bonding type. The apparatus includes a transparent base having a first surface and comprising a fluorescent material, first and a second bonding pads formed on the first surface, and a GaN semiconductor light-emitting device fixed on the first surface. A first lead frame includes a first mount which faces a dominant light emitting direction of the light-emitting apparatus and on which the first bonding pad is to be fixed, and a second lead frame includes a second mount which faces the dominant light emitting direction and on which the second bonding pad is to be fixed. The light-emitting device comprises a substrate, a light-emitting layer and a positive electrode comprising a light non-transmissible material, the positive electrode being disposed on an opposite side of the light-emitting layer from the substrate and reflecting light from the light-emitting layer in a direction through the substrate and the base. Further, the positive electrode is connected by a bonding wire to a surface of one of the first and second bonding pads, one of the pair of lead frames being connected to the surface.

In another aspect (e.g., as recited in claim 26) the semiconductor light-emitting apparatus includes a base, first and second bonding pads formed on a first surface of the base, a light-emitting element formed between the first and second pads on the first surface of the base. The light-emitting element includes a substrate, a light-emitting layer formed on the substrate, and a first electrode disposed on an opposite side of the light-emitting layer from the base and comprising a light non-transmissible material for reflecting light from the light-emitting layer through the base, a sealing resin formed on the base and the light-emitting element, and a fluorescent material which is adjacent to the substrate and on an opposite side of the substrate from the light-emitting layer.

Conventional light-emitting apparatuses often include a fluorescent material in a sealing resin. However, the heat generated in such a device causes the sealing resin to change color causing a color change of the emitted light (Application at page 3, lines 11-23).

The claimed invention, on the other hand, includes a base including a fluorescent material (as similarly recited in claims 14 and 19 and new claim 39), or a fluorescent material which is adjacent to the substrate and on an opposite side of the substrate from the light-

emitting layer (as recited in claim 26) (Application at Figures 7-8; page 7, line 18-page 8, line 3; page 18, line 20-page 19, line 21). This allows for light of a constant color to be emitted for a longer period of time than in conventional light-emitting apparatuses (Application at page 3, lines 11-23).

The prior art references do not appear to teach or suggest these novel features.

II. THE 35 U. S. C. §112, SECOND PARAGRAPH REJECTION

The Examiner alleges that claims 14-38 are indefinite. Applicant submits, however that these claims are adequately enabled and are clearly and distinctly claim the subject matter regarded as the invention.

Specifically, Applicant notes that claims 14 and 19 have been amended to address the Examiner's concerns. Therefore, Applicant submits that these claims are clear and not indefinite.

III. THE PRIOR ART REFERENCES

A. The Genriyou, Nemoto and Yamada References

The Examiner alleges that Genriyou would have been combined with Nemoto and Yamada to form the claimed invention of claims 14-24. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Genriyou discloses a light-emitting device which is intended to stabilize light-emitting characteristics and to improve light utilization efficiency, by forming a light taking-out part side and an electric connection part side (Genriyou at Abstract).

Nemoto discloses a semiconductor light-emitting device for emitting light to a semiconductor substrate in the upper direction and a package window portion formed of a transparent heat sink. The device is bonded to the package window portion in accordance with an interconnection pattern (Nemoto at Abstract).

The Examiner concedes that the combination of Genriyou and Nemoto does not disclose each and every feature of the claimed invention. However, the Examiner alleges that the Genriyou/Nemoto combination would have been further combined with Yamada to form the claimed invention.

Yamada discloses a p-contact for a group III nitride semiconductor device. The p-contact is formed by depositing an electrode layer of palladium on an exposed surface of the contact layer in the device (Yamada at Abstract).

However, Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, these references are directed to different problems. Specifically, Genriyou is intended to improve light efficiency by forming a light taking-out part side and an electric connection part side, and Nemoto is intended to address heat problems in a light-emitting device package (Nemoto at col. 2, lines 20-27) whereas Yamada is merely directed to a p-contact which allegedly has a low resistance, and is reliable and inexpensive (Yamada at col. 3, lines 11-22). Therefore, these references are completely unrelated, and no person of ordinary skill in the art would have considered combining these references, absent impermissible hindsight.

Further, the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, the Examiner supports the combination by merely stating that it would have been obvious to combine Genriyou and Nemoto to mount the lens to the external electrodes, and to combine the Genriyou/Nemoto combination with Yamada to reduce the voltage required to drive a given current. However, this is completely unrelated to a purpose of the claimed invention and, therefore, insufficient to support the combination.

In addition, Applicant points out that the Examiner attempts to combine Nemoto with Genriyou such that the Genriyou device would include bonding pads for connecting a lead frame to a base. However, in Genriyou, the lead frame is “embedded in” (e.g., integrally formed inside of) the supporting body 101. Therefore, it would make no sense to include bonding pads in the Genriyou device.

Moreover, none of these references teaches or suggests “*wherein the inorganic material comprises a fluorescent material dispersed therein*”, as recited, for example, in claims 14, nor “*a transparent base having a first surface and comprising a fluorescent material*”, as recited in claim 19.

As noted above, conventional light-emitting apparatuses often include a fluorescent material in a sealing resin. However, the heat generated in such a device causes the sealing resin to change color causing a color change of the emitted light (Application at page 3, lines

11-23).

The claimed invention, on the other hand, includes a base including a fluorescent material (as similarly recited in claims 14 and 19 and new claim 39) (Application at Figures 7-8; page 7, line 18-page 8, line 3; page 18, line 20-page 19, line 21). This allows for light of a constant color to be emitted for a longer period of time than in conventional light-emitting apparatuses (Application at page 3, lines 11-23).

Clearly, the cited references do not teach or suggest these novel features. Indeed, the Examiner does not allege that this feature is taught or suggested by the Nemoto or Yamada references. Instead, the Examiner alleges that Genriyou teaches this feature. However, the Examiner is clearly incorrect.

Specifically, the Examiner alleges that paragraph [0024] in Genriyou teaches this feature. However, this passage in Genriyou merely teaches that the “translucency base material” 101 may include a fluorescent substance. Genriyou describes the translucency base material 101 as having a convex or concave lens shape (paragraph [0017]) and being formed of a resin such as a polycarbonate resin, epoxy resin, phenol resin, etc. (paragraph [0020]).

In other words, the Genriyou device is similar to the conventional devices discussed in the Background section of the Application, which include a fluorescent material in the sealing resin. Therefore, the Genriyou is likely to suffer from the same problems as the conventional devices, namely, heat generated by the device will cause a discoloration of the translucency base material.

In addition, even if Genriyou discloses a bonding wire, Genriyou discloses that the bonding wire connects a light-emitting chip 2 directly to a lead frame. That is, Genriyou does not even disclose a bonding pad, let alone a bonding wire which connects a positive electrode to a surface of one of the bonding pads, and one of the lead frames connected to the same surface.

Obviously, Nemoto does not teach or suggest a bonding wire for connecting a positive electrode to a bonding pad. Indeed, Nemoto teaches bonding the positive and negative electrodes of a light-emitting device directly to a package 32 (Nemoto at Figure 15E). Therefore, it would make not sense to use a bonding wire in the Nemoto device.

Thus, even assuming that Nemoto discloses bonding pads, Nemoto does not teach or suggest the unique configuration as in the claimed invention. Specifically, Nemoto does not

teach or suggest a bonding wire which connects a positive electrode to a surface of one of the bonding pads, one of the pair of lead frames being connected to that same surface. Indeed, the Nemoto device forms both the positive and negative electrodes on the same side of the light-emitting device, then bonds the electrodes to the package 32.

In other words, there is no need for a bonding wire for connecting an electrode to a bonding pad. Instead, Nemoto merely uses interconnect layers 41 for connecting the device 51 to the lead frame 58. Moreover, unlike the bonding wires in the claimed invention, in Nemoto the interconnection 41 merely connects to the side surface of the electrode pad 42. The lead frame 58, on the other hand, connects to the bottom surface of the electrode pad 42. As noted above, such a design would clearly not address the problems which the claimed invention was intended to address.

The Examiner further alleges that the Genriyou/Nemoto combination would have further been combined with Yamada to form the claimed invention. However, Yamada merely discloses a light-emitting device and does not even disclose a lead frame or how the device may be connected thereto.

Therefore, Yamada clearly does not teach or suggest “*wherein the inorganic material comprises a fluorescent material dispersed therein*”, as recited, for example, in claims 14, nor “*a transparent base having a first surface and comprising a fluorescent material*”, as recited in claim 19. Therefore, Yamada clearly does not make up for the deficiencies of the Genriyou/Nemoto combination.

Therefore, Applicant submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

B. The Hide Reference

The Examiner alleges that Genriyou would have been combined with Nemoto and Yamada, and that the Genriyou/Nemoto/Yamada combination would have been further combined with Hide to form the claimed invention of claims 25-37. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

First, Applicant submits that the Examiner is alleging that no less than four references would have been combined to reject the invention of claims 25-37. This is clearly unreasonable and necessarily would require impermissible hindsight. Therefore, based on this fact alone, the Examiner has failed to make a prima facie case of obviousness.

Further, Hide discloses a hybrid inorganic light-emitting device/luminescent polymer light-emitting source. The source includes an inorganic light-emitting source such as a p-n junction diode-containing device capable of emitting a first emitted output of light, and a photoluminescent polymer element positioned in the first emitted output of light (Hide at Abstract).

Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, these are directed to different problems. Specifically, Hide is directed to a hybrid device which contains a photoluminescent polymer. This is completely unrelated to the other references. Therefore, certainly no person of ordinary skill in the art would have considered combining these references, absent impermissible hindsight.

Further, the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, the Examiner supports the combination by merely stating that it would have been obvious to combine the Genriyou/Nemoto/Yamada combination with Hide to generate a greater variety of colors. However, this is unrelated to a purpose of the claimed invention and, therefore, insufficient to support the combination.

Moreover, none of these references teaches or suggests *“a fluorescent material which is adjacent to said substrate and on an opposite side of said substrate from said light-emitting layer”* as recited, for example, in claim 26.

As noted above, unlike conventional light-emitting apparatuses which often include a fluorescent material in a sealing resin, the claimed invention a fluorescent material which is adjacent to the substrate and on an opposite side of the substrate from the light-emitting layer (Application at Figures 7-8; page 7, line 18-page 8, line 3; page 18, line 20-page 19, line 21). This allows for light of a constant color to be emitted for a longer period of time than in conventional light-emitting apparatuses (Application at page 3, lines 11-23).

Clearly, Hide does not teach or suggest this novel feature. Indeed, the Examiner attempts to equate the photoluminescent layer 34 with the fluorescent material of the claimed

invention. However, this is clearly incorrect.

The Application explains that “part of the light from the light-emitting device 20 is absorbed by the fluorescent material 201 ... to generate fluorescence” (Application at page 19, lines 15-18). The term “fluorescence” is defined as “luminescence that is caused by the absorption of radiation at one wavelength followed by nearly immediate reradiation usually at a different wavelength and that ceases almost immediately when the incident radiation stops” (*Webster’s Universal Encyclopedic Dictionary*, 2002, page 707). In one exemplary embodiment, yttrium aluminum garnet (YAG) is used as the fluorescent material (Application at page 18, line 25).

In contrast, Hide discloses merely a photoluminescent material. The term “photoluminescence” is defined as “luminescence induced by the absorption of infrared radiation, visible light, or ultraviolet radiation” (*Webster’s New Universal Unabridged Dictionary*, 1996, page 1459).

Thus, clearly, a photoluminescent material is not necessarily a fluorescent material which fluoresces. That is, the mere fact that a material absorbs some form of radiation to induce a luminescence, does not necessarily mean that the material fluoresces (e.g., see Atkins, P. W., *Physical Chemistry*, 3rd Ed., 1986, pages 470-472, a copy of which is attached hereto as Exhibit 1).

Therefore, Hide clearly does not teach or suggest a fluorescent material. Therefore, Hide clearly does not make up for the deficiencies of the Genriyou/Nemoto/Yamada combination (*arguendo*).

Further, none of these references teach or suggest “a sealing resin formed on said base and said light-emitting element” as recited, for example, 26. As noted above, the sealing resin helps to protect the light-emitting element (Application a page 14, lines 14-24).

Therefore, Applicant submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

C. The Oshio Reference

The Examiner alleges that Genriyou would have been combined with Nemoto and

Yamada, and that the Genriyou/Nemoto/Yamada combination would have been further combined with Oshio to form the claimed invention of claim 38. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Applicant again points out that the Examiner is alleging that no less than four references would have been combined to reject the invention of claim 38. This is clearly unreasonable and necessarily would require impermissible hindsight. Therefore, based on this fact alone, the Examiner has failed to make a prima facie case of obviousness.

Further, Oshio discloses a semiconductor light emitting device includes a semiconductor light emitting element, a resin stem having a thermosetting resin on the resin stem so as to cover the entire upper surface and continuous upper part of side surfaces of the resin stem to a predetermined depth (Oshio at Abstract).

Applicant respectfully submits that these references would not have been combined as alleged by the Examiner. Indeed, these are directed to different problems. Specifically, Oshio is merely directed to a method of manufacturing a light-emitting device which manufactures a lens easily (Oshio at col. 1, lines 58-63) which is completely unrelated to the other references. Therefore, certainly no person of ordinary skill in the art would have considered combining these references, absent impermissible hindsight.

Further, the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, the Examiner supports the combination by merely stating that it would have been obvious to combine the Genriyou/Nemoto/Yamada combination with Hide to focus the light generated from the light-emitting chip. However, this is unrelated to a purpose of the claimed invention and, therefore, insufficient to support the combination.

Moreover, none of these references teaches or suggests “*a fluorescent material which is adjacent to said substrate and on an opposite side of said substrate from said light-emitting layer*” as recited, for example, in claim 26.

As noted above, unlike conventional light-emitting apparatuses which often include a fluorescent material in a sealing resin, the claimed invention a fluorescent material which is adjacent to the substrate and on an opposite side of the substrate from the light-emitting layer (Application at Figures 7-8; page 7, line 18-page 8, line 3; page 18, line 20-page 19, line 21).

This allows for light of a constant color to be emitted for a longer period of time than in conventional light-emitting apparatuses (Application at page 3, lines 11-23).

Clearly, Oshio does not teach or suggest this novel feature. Indeed, Applicant notes that the Examiner does not even allege that Oshio teaches or suggests these novel features.

In fact, Oshio does not even teach or suggest a fluorescent material, let alone a fluorescent material which is adjacent to the substrate and on an opposite side of the substrate from the light-emitting layer, as in the claimed invention (e.g. as recited in claim 26). Therefore, Oshio clearly does not make up for the deficiencies of the alleged Genriyou/Nemoto/ Yamada combination.

Therefore, Applicant submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

III. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicant submits that claims 14-16, 18-20, 22-23, 26-36, and 38-39, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

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The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

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